Health Consultation

Evaluation of the Mt. Pleasant Landfill Closure Plan

Clallam County, Washington

Revised: August 9, 2000

Prepared by
The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Foreword

The Washington State Department of Health (DOH) has prepared this Health Consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This Health Consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this Health Consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. The Health Consultation allows DOH to respond quickly to a request from concerned residents for health information on hazardous substances. It provides advice on specific public health issues. DOH evaluates sampling data collected from a hazardous waste site or industrial site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health.

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Glossary

Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Aquifer	An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs.
Contaminant	Any chemical that exists in the environment or living organisms that is not normally found there.
Dose	A dose is the amount of a substance that gets into the body through ingestion, skin absorption or inhalation. It is calculated per kilogram of body weight per day.
Exposure	Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short term (acute) or long term (chronic).
Groundwater	Water found underground that fills pores between materials such as sand, soil, or gravel. In aquifers, groundwater often occurs in quantities where it can be used for drinking water, irrigation, and other purposes.
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Inorganic	Compounds composed of mineral materials, including elemental salts and metals such as iron, aluminum, mercury, and zinc.
Monitoring wells	Special wells drilled at locations on or off a hazardous waste site so water can be sampled at selected depths and studied to determine the movement of groundwater and the amount, distribution, and type of contaminant.

Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides which are not easily dissolved in water.
U.S. Environmental Protection Agency (EPA)	Established in 1970 to bring together parts of various government agencies involved with the control of pollution.
Volatile organic compound (VOC)	An organic (carbon-containing) compound that evaporates (volatilizes) easily at room temperature. A significant number of the VOCs are commonly used as solvents.

Background and Statement of Issues

This health consultation was written in response to a request for comments from the Clallam County Department of Health and Human Services on the Closure and Post-Closure Plan for the Mt. Pleasant Landfill, Port Angeles, Washington. This consultation evaluates public health issues associated with the closure plan and the potential for exposure to contaminants originating at the landfill. The Washington State Department of Health (DOH) prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR has been petitioned by the community to assess the potential impacts of this landfill on public health. This consultation evaluates only those issues associated with the closure plan and will be followed by the more comprehensive assessment by ATSDR.

The Mt. Pleasant Landfill is a 76-acre landfill located on Mt. Pleasant Road two miles east of Port Angeles, Washington. The site was originally used to mine sand and gravel until purchased by Rayonier Incorporated in 1978 for disposal of wastes generated from its pulp and paper mill located in Port Angeles. The landfill contains two cells that received wastewater treatment plant sludge, ash and wood waste from the pulp mill (Figure 1). The Sludge cell received treatment plant sludge from 1979 until 1990 while the Phase 1 cell took ash and wood waste from 1989 through 1997 when the mill was shutdown. Dredged material from the log yard pond and chip barge berth were also disposed of in the landfill.[1]

Each cell currently has both a groundwater and leachate collection system but only the Phase 1 cell has an artificial liner. The cells are underlain by a layer of clay thought to be contiguous throughout the site. Gravity and pumping stations move leachate into two on-site lagoons while groundwater and surface water runoff are directed into a storm water detention pond. Leachate is taken by truck to an off-site wastewater treatment facility. The storm water detention pond is drained by a pump station, as needed, into East Fork Lees Creek through underground culverts. Prior to the upgrade in 1989, storm water, groundwater and leachate from the Sludge cell drained though culverts at the southeast corner of the landfill into the Morse Creek drainage area.[1]

Prior to landfill construction, shallow groundwater in the area around the landfill flowed to the southwest. However, installation of the leachate and gr4oundwater collection systems draws groundwater into the landfill from all directions.[2] Within the site, shallow groundwater moves east and is recharged by the stormwater collection pond. The shallow aquifer is separated from a deeper aquifer by a clay aquitard.[3] Depth to groundwater varies seasonally and has been measured from 9 to 36 feet below ground surface.[1]

Environmental Sampling

Landfill operators are required to monitor the level and quality of groundwater. There are currently 17 groundwater monitoring wells installed on-site that are sampled regularly for this purpose. Some of these wells including the upgradient well MW-8 have exceeded secondary maximum contaminant levels for manganese and iron.[3] In addition, the storm water outfall at Lees Creek is also sampled in accordance with the National Pollutant Discharge Elimination

System **(**NPDES) permit issued for this discharge. Discharges to surface water typically meet standards.[1]

In 1997, the U.S. Environmental Protection Agency conducted a Preliminary Assessment/Site Investigation of the landfill in response to a community petition. During this investigation, EPA sampled on-site waste material, surface soil, leachate, groundwater and surface water. Analysis included volatile organic chemicals (VOCs), semi-volatile organic chemicals (SVOCs), metals and dioxins/furans.[1]

Two borings were drilled into each cell from which samples were taken from various depths. Results of this sampling indicate that the surface soil covering both cells does not contain elevated levels of contaminants. One of the waste samples taken from a boring of the Sludge cell had high levels 4-methylphenol, acetone, 2-butanone and toluene. Other waste samples contained elevated levels of metals and dioxins/furans when compared to a single off-site background soil sample.[1] A sample taken from an uncovered ash pile located in the northeast section of the Phase 1 cell also found elevated levels of metals, dioxins and furans. Concentrations of those contaminants in waste material and ash determined to be significant by EPA are given in Table 1 below along with background levels.

Table 1. Concentrations of contaminants in landfill waste material at the Mt. Pleasant Landfill, Port Angeles, Washington.

	Landfill Waste		**Ash**	**Background**	
	Max	Average		Area Soi1 [a]	Puget Sound Soil [b]
Metals (ppm)					
arsenic	14.2	5.2	9.9	2.6	7
barium	317	128	362	45.3	NA
cadmium	8.5	1.8	8.8	1.2	1
chromium	86.5	39.7	78.6	17.1	48
cobalt	13.6	9.6	NE	7.9	NA
manganese	3060	1188	3610	299	1200
zinc	841	60	705	139	85
Organics (ppb)					
dioxin-TEQ	0.079	0.047	1.8	0.002	0.012 [c]
acetone	17000	NA	<15	<120	NA
2-butanone	4100	NA	<15	<120	NA
4-methylphenol	1100000	NA	<500	<400	NA
toluene	2500	NA	<15	<12	NA

a = Area soil background is based on a single soil sample (RS-13) taken by EPA in a residential yard approximately 1000 feet from the site.
b = Metals background taken from *Natural Background Soil Metals Concentrations in Washington State* from Reference 5.
c = Background dioxin-TEQ level in U.S. soil derived from Reference 6.
ppm = parts per million ppb = parts per billion TEQ = Toxicity equivalent quotient.
NA = Not available ND = Not detected NE = Not elevated

Two sediment samples taken from the surface water detention pond and one sediment sample taken from the leachate lagoon showed elevated levels of some metals. A single surface water

sample was also taken from the leachate pond. Concentrations of metals in sediment were lower than those found in waste boring samples. Some metals in the leachate sample were higher than the background groundwater sample used for comparison. On-site sediment and surface water were not analyzed for dioxins and furans.

Off-site sampling included sediment, surface soil and groundwater. Nine sediment samples were collected from East Fork Lees Creek, Morse Creek drainage area and Morse Creek. Twenty surface soil samples were collected from residential areas near the site. Groundwater samples were collected from an upgradient monitoring well (MW-8), a downgradient monitoring well (MW-10) and the Four Seasons public drinking water supply well. Off-site samples were analyzed for VOCs, SVOCs and metals. In addition, off-site sediment samples from the Morse Creek drainage and some surface soil samples were analyzed for dioxins/furans.[1,4] Concentrations of metals, dioxins/furans determined to be elevated in off-site sediment and soil are given in Table 2 below.

Table 2. Concentrations of contaminants in off-site soil and sediment near the Mt. Pleasant Landfill, Port Angeles, Washington.

	Sediment [a]		**Surface Soil**		**Background**		
	Max	Average	Max	Average	Area Sediment [b]	Area Soil [c]	Puget Sound Soil [d]
Metals (ppm)							
arsenic	12.2	5.5	NE	NA	1.5	2.6	7
barium	238	179	239	114.3	34.2	45.3	NA
chromium	NE	NA	92.5	32.7	33.7	17.1	48
cobalt	18.4	14.2	14.0	9.3	7.5	7.9	NA
lead	14.4	9.8	NE	NA	2.8	355	24
manganese	5400	3689	1240	675.8	291	299	1200
Organics (ppb)							
DDT	NE	NA	31	7.1	ND	2.6	NA
dioxin-TEQ	0.013	0.003	0.1	0.011	0.0002	0.002	0.012 [e]

a = Based on overland surface water migration pathway sampling. Dioxin analysis of wetland sediments averaged 0.003 ppb with a maximum of 0.014 ppb.
b = Area sediment background is based on a single soil sample (LC-03-SD) taken by EPA from East Fork Lees Creek.
c = Area soil background is based on a single soil sample (RS-13) taken by EPA in a residential yard approximately 1000 feet from the site.
d = Metals background taken from *Natural Background Soil Metals Concentrations in Washington State* from Reference 5.
e = Background dioxin-TEQ level in U.S. urban soil derived from Reference 6.
ppm = parts per million ppb = parts per billion TEQ = Toxicity equivalent quotient
NA = Not available ND = Not detected NE = Not elevated

Table 3 gives the concentrations of metals and dioxins/furans determined to be elevated in off-site groundwater monitoring wells.[1,4] The Four Seasons Park public supply well is 12 feet deep, serves 217 persons via 91 connections and is located about one-half mile southeast and downgradient of the landfill. Sampling and analysis of this well by EPA found no detections that were significantly above background.[1] Historic sampling of this well for VOCs, metals, nitrate and coliform has shown no violations of drinking water standards. The Four Seasons Park well is the closest downgradient water supply well with respect to the landfill.

Table 3. Concentrations of contaminants in off-site groundwater near the Mt. Pleasant Landfill, Port Angeles, Washington..

	MW-10		**Background** (MW-08)	
	Max	Average	Max	Average
Metals (ppb)				
copper	28.6	11.3	11.4	8.1
manganese	1960	1331	1880	1152
zinc	22.4	11.5	12.5	9.6
Organics (ppq)				
dioxin-TEQ	1.6	NA	3.3	NA

TEQ = Toxicity equivalent quotient.
ppb = parts per billion ppq = parts per quadrillion

The closure plan calls for additional material to be filled in order to bring the landfill to grade (i.e., an even surface). These materials are the same as those already present in the landfill and include dredged material, hog-fuel boiler ash and wood waste. Additional fill will be tested for leachability of both organics and inorganics. In addition, pulp wood waste and ash will also be tested for total dioxin/furan content. Once the landfill is brought to grade, a multi-layered cap will be installed that includes a plastic membrane sandwiched between a soil layer underneath and sand above. A final layer of top soil seeded with grass will also be added. The post-closure plan includes 20-year monitoring of groundwater, stormwater and surface water at the point of discharge into Lees Creek.[3]

Discussion

Analysis of waste from both the Sludge and Phase I cells shows that metals and dioxins/furans are elevated above background concentrations determined for area soil. One sample of landfill waste also showed high levels of some VOCs. Off-site sampling of soil and sediment indicates that some metals, dioxins/furans and DDT are also higher than area background levels. Groundwater sampling does not show elevations for any contaminant.

The determination that these contaminants are elevated was based on comparisons of each sample with a single area “background” sample. This approach is accordance with EPA protocol for site investigations that are designed to provide information for their Hazard Ranking System. As shown in the preceding tables, however, average concentrations of those contaminants determined by EPA to be elevated are, in many cases, similar to regional background levels.

Metals

Table 1 shows that some metals are elevated in hogged fuel boiler ash. However, only one ash sample was analyzed. Average levels of contaminants in fill material are comparable to area or regional background concentrations.[5] Off-site sediment sampling in the surface water drainage

area located on the southeast slope of the landfill indicates that some metals, primarily manganese, are elevated. It is possible that metals from uncovered ash could have migrated from the landfill into the sediments in this area. However, no contaminants are elevated in Morse Creek into which this drainage empties. Barium and cobalt appear to be slightly elevated in off-site sediment and soil when compared to area background, however, no regional background numbers are available for these metals.

Dioxins/Furans

Dioxin/furan analysis of landfill waste and ash show dioxin-TEQs above both area and regional background levels. The dioxins/furans present in the landfill are associated with the hog-fuel boiler ash. It is speculated that this ash from the Rayonier site contains more dioxins/furans than other hog-fuel boiler ash because the timber was stored in salt water which supplied the chlorine source for the formation of dioxin/furans during combustion. Average levels of dioxins/furans in off-site sediment and soil are consistent with levels expected to be present in urban soils in the United States.[6] Dioxin/furan levels in the drainage area where migration of contaminants would most likely have occurred are consistent with area background and below background levels in U.S. urban soil. Dioxin/furan analysis of groundwater samples are also similar to area background levels.

Dioxin Toxic Equivalency (TEQ)

Dioxin-TEQ concentrations presented here are based on modified levels of the various dioxin and furan congeners detected. The concentration of each detected congener in a sample is multiplied by a corresponding toxicity equivalency factor (TEF). The resulting products are then added together giving the dioxin-TEQ. The TEFs for each congener are based on the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin.

The average dioxin-TEQ level found in residential soil is 11.2 parts per trillion (ppt) with a maximum detection of 100.3 ppt and a geometric mean of 3.0 ppt (see Appendix A). The average dioxin-TEQ level estimated for urban soils in the United States is 12 ppt.[6] Ecology calculated a geometric mean dioxin-TEQ of 1.9 ppt for non-urban western Washington soils.[7] The average dioxin-TEQ level found in residential soils near the landfill is below ATSDR's screening level 50 ppt.[8] Levels of contaminants below ATSDR screening levels are not considered to be of health concern.

Residential soil samples SS-12 and SS-04 are the only off-site soil samples that exceed the ATSDR screening value. These two samples contain dioxin-TEQ levels of 100.3 and 96.2 ppt and were taken from the roof drip line of two different homes. One home is located to the northwest of the landfill whole the other is to the southeast. Although both of these levels exceed the screening value, they are below ATSDR's action level of 1000 parts per trillion (i.e. 1 part per billion). Dioxin-TEQ levels in soil that exceed the screening value but are below the action level should be considered for further, more site-specific evaluation.

The extremely low solubility of dioxin/furans and their strong adsorption to organic material indicate that migration into groundwater is unlikely.[9] However, co-occurrence with organic solvents could enhance the mobility of dioxins/furans in soil and groundwater.[10] While there does not appear to be any source of solvent in landfill wastes, one waste sample did indicate significant levels of organic solvent including toluene and acetone.

The contribution of fugitive dust from the landfill to the levels of dioxin/furans found in nearby residential soils is not known. It is likely that some, if not most, of the dioxin found in residential soil near the landfill is the result of deposition from nearby combustion sources. Past and present combustion sources in the Port Angeles area include the former Rayonier hog-fuel boiler municipal waste landfill burning, residential wood stoves/fireplaces and automobiles. Regardless of source, dioxins/furans in residential soil represent a completed exposure pathway for residents in the area.

Environmental Exposure and Children

No pathways of exposure to contaminants originating at the landfill are evident. Sediment in the drainage area is not readily accessible. The nearest drinking water supply well located in the Four Seasons Park residential area contained no metals above background levels. A site visit of the landfill on May 2, 2000, revealed that both the Sludge and Phase I cells are covered with top soil and vegetation reducing the potential for dust migration off-site. In addition, trees separate the landfill from the Four Seasons Park and should serve to reduce any dispersion of dust from the landfill to this residential area.

Conclusions

Levels of some metals and dioxins/furans in landfill waste material are elevated above area and/or regional background levels. Levels of these contaminants in off-site groundwater and soil are consistent with area and or regional background levels. No exposure pathways are evident that would allow for contact with landfill contaminants in off-site groundwater or soil.

Slight elevations of metals in soil and sediment samples taken along the southeast slope of the landfill could have been the result of contaminant migration via surface water runoff from uncovered fill material. Manganese levels in drainage area sediment are elevated. However, drainage area sediments are not considered accessible for prolonged contact.

The source of the dioxin/furans found in residential soils near the landfill is not clear. It is likely that past and present combustion sources in the area have significantly contributed to this contamination. Average dioxin-TEQ levels in residential soil are consistent with background levels and are also below ATSDR screening levels indicating that they are not at levels of health concern. However, two residential soil samples exceed the ATSDR screening value indicating that further analysis is warranted. A comprehensive analysis of the exposure and possible health

hazards posed by contaminants associated with the landfill is being prepared by ATSDR in response to a community petition.

Addition of the landfill cap will ensure that any migration of contaminants from the landfill that might have occurred in the past will be reduced or eliminated. The proposed monitoring includes analysis of landfill gas, groundwater, on-site surface water and off-site surface water at the point of discharge into Lees Creek.

Recommendations

Workers implementing the landfill closure plan should wear dust protection to prevent inhalation of contaminants in ash that could be liberated during grading.

Action Proposed

- Contractors will be required to implement site safety plans in accordance with the closure plan.

Dust control measures should be used to minimize dust generation during regrading of the landfill to reduce the potential for on and off-site exposure to contaminants in ash.

Action Proposed

- DOH will provide this consult to the Clallam County Department of Health and Human Services.

Dioxins/furans in residential soil near the landfill should be evaluated in the health assessment currently being prepared by ATSDR.

Action Proposed

- ATSDR will evaluate potential past, current and future exposure to contaminants originating from the landfill.

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Figure 1. Site map of the Rayonier Mt. Pleasant Landfill located in Port Angeles, Washington (adapted from Ref. 3).

Appendix A: Dioxin-TEQ Results for Residential Soil Sampling
near the Mt. Pleasant Landfill, Port Angeles, Washington (parts per trillion or ppt).

Soil Sample #	Dioxin-TEQ	Description
SS28 (Background)	*1.7*	Roof drip line sampling from PA/SI Addendum (Reference 4)
SS04	**100.3**	
SS05	5.8	
SS08	0.97	
SS11	1.1	
SS12	**96.2**	
SS13	13.7	
SS14	3.7	
SS15	2.9	
SS18	8.2	
SS20	5.9	
SS24	0.12	
SS25	22.8	
SS26	21	
SS27 (Background)	*0.25*	Yard sampling from PA/SI Addendum (Reference 4)
SS09	0.05	
SS16	1.1	
SS17	2.9	
SS19	0.14	
SS01	0.22	
SS02	2.3	
SS21	1.5	
SS22	2.1	
SS23	5	
SS10	0.82	
SS06	1.7	
SS07	4.4	
RS-13-SS (Background)	*2.3*	Yard sampling from PA/SI (Reference 1)
RS-01-SS	2.3	
RS-04-SS	6.7	
RS-09-SS	4.3	
RS-12-SS	3.6	
RS-18-SS	8.5	
RS-19-SS	17	
Mean	**11.2**	**Summary Statistics (Includes all samples except background)**
SD	**24.0**	
Median	**3.6**	
Geometric mean	**3.0**	
Trimmed Mean (20%)	**5.1**	
Max	**100.3**	
Min	**0.05**	
Count	**31**	

Samples that are **bolded** exceed the ATSDR screening value of 50 ppt but are below the action level of 1 parts per billion (ppb).